

MW3105

DIGITAL CLAMP MULTIMETER

M MW3105 A
01

INTRODUCTION

1.1 - Unpacking and inspection

Upon removing your new Digital Clamp Meter from its packing, you should have the following items:

1. Digital Clamp Meter.
2. Test lead set (one black, one red).
3. Carrying case.
4. Instruction manual.
5. Battery (installed).

1.2 - Meter Safety

Terms as marked on equipment:



ATTENTION - Refer to manual.



DOUBLE ISOLATION - (Protection Class II)



DANGER - Risk of electric shock.

Symbols in this manual



This symbol indicates where cautionary or other information is found in the manual.



Battery

1.3 Front panel

Refer to figure 1 and the following steps to familiarize yourself with the instrument's front panel, controls and connectors.

1. **Hz Ω F**  Test lead input for frequency, resistance, capacitance, continuity and diode test measurements.
2. **Volt Plug** . Positive (or high) test lead input for voltage measurements.
3. **COM Plug**. Black (common neutral, ground), low side test lead input.
4. **Current Clamp Jaws**. Use for current measurements without disconnecting circuit. Simply open jaws and loop around conductor.
5. **Lever**. Press to open, or release to close jaws.
6. **Power/Function/Range Selector**. Rotary switch to turn power off or to select measurement range and function.

7. Display, LCD Readout . Indicates function selected, data reading selected (PEAK, HOLD, etc.) over-range, polarity (-), and low battery status. Digit display: 3-3/4 digits with maximum reading 4000 for, with automatic placement of decimal point.

8. HOLD. Press to freeze present reading at display and to display "HOLD" annunciator. Press again to exit.

9. MAX/MIN. Press to record and enable display of minimum and maximum input levels. Press this button to increment through levels recorded and present input level. Display shows HOLD MAX or MIN and active level.

10. PEAK. Push button store peak value of a varying input, PEAK displayed. Press to toggle in and out.

11. ZERO. Push button to obtain difference between a stored reference and present reading, ZERO displayed. Stored reference is input level when ZERO data mode is enabled. Press and hold button down for at least 2 seconds to exit.

12. RANGE. Button to select manual range mode and to increment present range;  shown at display, in this mode, each time button is pressed range increments by 0.1. Range starts from active autoranging level. To exit, press and hold down this button for about 2 seconds.

13. Bargraph. Provides analog display of magnitude and direction of change of input; 42 segments

SPECIFICATIONS

2.1 General specifications

Display : 3 $\frac{3}{4}$ digit LCD with a maximum reading of 3999

Polarity : Automatic polarity indicated. « - » shown, « + » assumed.

Measuring Rate : Nominal, 2 mes/sec.; Cap. & Freq., 1 mes/sec.

Overrange Indication: OL shown, all digits blank.

Low Battery Indication  symbol shown at about 7.4 V, or less.

Power Requirement: Single 9 V battery (NEDA 1604A, 6F22).

Battery Life : 100 hours typical (with alkaline)

Jaw opening : 57mm (2.24").

Position error : Add 1% to specified accuracy if conductor is not centered in jaws.

Dimensions (H x W x D) : 277 x 102 x 49 mm (10.9" x 4" x 1.9").

Weight : 540 g (18.9 oz), includes battery.

Accessories supplied: battery, carrying case, test leads, instruction manual.

Temperature coefficient: 0.1 x specified accuracy/°C (<18 °C or >28 °C)

Auto Power OFF : if not used, turns meter off after 30 minutes typical.

2.2 Environmental conditions

Indoor use only

Maximum altitude of use: 2000 meters.

Operating temperature : 0 °C to 50 °C, <70% relative humidity.

Storage temperature : -20 °C to +60 °C, <80% relative humidity with battery removed.

Installation category : IEC1010 Cat III 600V.

Pollution degree : 2

2.3 Electrical Specifications

Accuracy is given as \pm (% of reading + number of digits) from 18 °C to 28 °C, with relative humidity up to 70%.

Temperature coefficient: 0.1 x specified accuracy/°C (t <18 °C or t >28 °C).

DC Current - Manual ranging

Range	Resolution	Accuracy	Overload Protection
400A	100mA	$\pm(1.5\% + 5 \text{ dgt})$	1200A for 60 s maximum
1000A	1A	0-600A $\pm(1.5\% + 5 \text{ dgt})$	
		600-800A $\pm(2.5\% + 5 \text{ dgt})$	
		800-1000A $\pm(3.5\% + 5 \text{ dgt})$	

Specifications given from 5% to 100% of the range. Accuracy given after having performed auto-zero of the clamp.

AC Current - Manual ranging

Range	Resolution	Accuracy 50-60Hz	Accuracy 60-400Hz	Overload Protection
400A	100mA	$\pm(1.5\% + 5 \text{ dgt})$	$\pm(3.0\% + 5 \text{ dgt})$	1200A for 60 s maximum
1000A	1A	0-600A $\pm(1.5\% + 5 \text{ dgt})$	0-600A $\pm(3.0\% + 5 \text{ dgt})$	
		600-1000A $\pm(2.0\% + 5 \text{ dgt})$	600-1000A $\pm(3.5\% + 5 \text{ dgt})$	

Specifications given from 5% to 100% of the range.

Crest factor : 3 max. Add 1% to accuracy for crest factor between 2 and 3.

Conversion : TRUE RMS.

DC Voltage (using test leads, auto or manual ranging)

Range	Resolution	Accuracy	Input Impedance
400mV	100 μ V	$\pm(0.5\% + 1 \text{ dgt})$	> 1000M Ω
4V	1mV		11M Ω
40V	10mV		10M Ω
400V	100mV		10M Ω
1000V	1V		10M Ω

Overload protection : 1000V DC or 750 VAC RMS.

AC Voltage (using test leads, auto or manual ranging)

Range	Resolution	Accuracy 50Hz to 500Hz	Input Impedance	Overload protection
400mV*	100 μ V	$\pm(1.5\% + 4 \text{ dgt})$	> 1000M Ω // 100pF	1000V DC or 750V AC RMS
4V	1mV		11M Ω // 100pF	
40V	10mV		10M Ω // 100pF	
400V	100mV		10M Ω // 100pF	
1000V	1V		10M Ω // 100pF	

Specifications given from 5% to 100% of the range (except 400mV range, see *)

Conversion : TRUE RMS

Crest factor : 3 max. Add 1% to accuracy for crest factor between 2 and 3

* **Input signal** >40mV, bandwidth 50-100Hz for this range.

Resistance (using test leads, auto and manual ranging)

Range	Resolution	Accuracy	Open circuit voltage	Overload protection
400 Ω	0.1 Ω	$\pm(1.2\% + 4 \text{ dgt})$	0.4V	500V DC or AC RMS
4K Ω	1 Ω	$\pm(1.0\% + 2 \text{ dgt})$	0.4V	
40K Ω	10 Ω	$\pm(1.0\% + 2 \text{ dgt})$	0.4V	
400K Ω	100 Ω	$\pm(1.0\% + 2 \text{ dgt})$	0.4V	
4M Ω	1K Ω	$\pm(1.5\% + 4 \text{ dgt})$	0.4V	
40M Ω	10K Ω	$\pm(2.0\% + 4 \text{ dgt})$	0.4V	

Continuity Test (using test leads)

Range	Threshold	Response time	Test current
400 Ω	< 40 Ω	100ms typ.	<0.4mA

Overload Protection : 500V DC or AC RMS

Diode Test (using test leads)

Range/Resolution	Accuracy	Open circuit voltage	Test current
4V / 1mV	$\pm(1.0\% + 2 \text{ dgt})$	3.2V	about 0.6mA

Overload Protection : 500V DC or AC RMS**Frequency** (using test leads, auto or manual ranging)

Range	Resolution	Accuracy	Trigger level	Overload protection
100Hz	0.01Hz	$\pm(0.1\% + 10 \text{ dgt})$	2.5 V RMS	500V DC or AC RMS
1kHz	0.1Hz	$\pm(0.1\% + 4 \text{ dgt})$		
10kHz	1Hz	$\pm(0.1\% + 4 \text{ dgt})$		
100kHz	10Hz	$\pm(0.1\% + 8 \text{ dgt})$		
400kHz	100Hz	$\pm(0.1\% + 20 \text{ dgt})$		

NOTE: Frequencies <100Hz or >100kHz, readings may tend to be unstable.**Minimum frequency** : 1Hz

Capacitance (using test leads, auto and manual ranging)

Range	Resolution	Accuracy	Overload protection
4nF	1pF	$\pm(1.5\% + 40 \text{ dgt})^*$	500V DC or AC RMS
40nF	10pF	$\pm(1.5\% + 4 \text{ dgt})^*$	
400nF	100pF	$\pm(1.5\% + 4 \text{ dgt})$	
4 μ F	1nF	$\pm(1.5\% + 4 \text{ dgt})$	
40 μ F	10nF	$\pm(1.5\% + 4 \text{ dgt})$ for $C < 20\mu\text{F}$	

* Accuracy specified after zeroing in relative mode.

Display is indicative above 20 μ F (no accuracy specified)

OPERATION

This instrument has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus and has been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in safe condition.

3.1 Precaution and preparations for measurements

1. Read, thoroughly understand and follow the SAFETY instructions given in this manual.
2. Examine your test leads. Make sure they are in good condition, free from cracks, etc., and that they make good contact with the plugs of your meter. Do this for safe operation and to avoid false readings.
3. Before taking a measurement, review the related instructions in this manual.
4. Before taking a measurement, estimate its expected value. If you are considerably out of an expected range, carefully review your circuit under test; it could be defective.
5. If value of measurement is unknown, start with the highest range.
6. Stay within the operating range of your meter. Never exceed the 750 V AC or 1000 V DC maximum limits and 500 V from COM plug to earth ground or reference.
7. If an over-range is shown, immediately switch to a higher range.



CAUTION

Never switch between ranges while connected to high voltage. This prevents damage to the instrument.

- When using the jaws to take a measurement, center a single conductor of a cable in the jaws and perpendicular to the jaws to avoid false readings. When two or more conductors are in the jaws when an AC reading is taken, current flows in each wire tend to cancel each other. Off center wires produce lower readings.
- For reliable measurements, replace battery when the low battery symbol  appears on display. See MAINTENANCE instructions to replace battery.
- Set function selector to OFF when not in use to conserve battery power.

3.2 VOLTAGE MEASUREMENTS (Use these instructions for AC and DC measurements).



CAUTION

Never try to measure voltages greater than 750V AC or 1000V DC.

- Select AC or DC voltage and range. If range is unknown, start with the highest range. Set function selector to **V=** for DC measurements or to **V ~** for AC measurements.
- Plug red test lead to VOLT plug, black test lead to COM plug.
- Connect black test lead to common of circuit, red lead to point being measured at this circuit.
- Value at display is actual level being measured, + assumed, - (negative) shown. In AUTO mode only: decimal point is correctly located for best resolution.



CAUTION

Never switch between ranges while connected to high voltage to avoid personal harm and/or damage to the meter.

6. Disconnect test leads from voltage source then switch meter to **OFF** to conserve power.

3.3 RESISTANCE / CONTINUITY MEASUREMENTS



CAUTION

Remove power from circuit under test before making resistance measurements.

1. Verify that power is off and that any capacitors are discharged in circuit about to be tested.
2. For resistance measurements: In AUTO (default) mode, set function selector to Ω Range is automatically selected for best resolution. If the meter is operating in manual ranging mode, select range that closely matches actual resistance expected.
3. For continuity measurements:
Set function selector to  position.

Plug black test lead into COM plug. Plug red test lead into Hz Ω F plug.

5. Connect test leads across desired measuring points.

6. Resistance measurements: Read resistance at display in Ω , $k\Omega$, or $M\Omega$ as shown by annunciator symbol.
Continuity measurements: Audible tone sounds when resistance is less than about: 40 ohms.
7. Switch meter to **OFF** when readings are done to conserve battery power.

3.4 DIODE TESTS



CAUTION

Remove power from circuit under test before making diode measurements.

1. Verify that power is off and that any capacitors are discharged in circuit about to be tested.
2. Set function selector to  position.
Continuity  is the default symbol.
3. Plug black test lead into COM plug. Plug red lead into Hz Ω F  plug.
4. Connect black test lead to cathode of diode, red test lead to its anode. Typical forward voltages should be about as follows:
Silicone diode: 0.7 V.
Germanium diode: 0.3 V.
5. Reverse test leads, black to anode, red to cathode. Voltage reading should be: 3.1V.
6. Note: Make sure that correct reading is obtained in forward and reverse positions. If diode is partially shorted, the same or higher reading may be obtained in both positions. If diode is open, an overload OL may be shown in both positions.
7. Switch meter to **OFF** to conserve power when tests are done.

3.5 AC CURRENT MEASUREMENTS



CAUTION

Never try to measure currents where the maximum voltage between any conductor and ground exceeds 500 V to avoid personal harm and/or damage to the meter.

1. Remove test leads from meter.
2. Set function selector to **A ~** for AC current measurements and choose range. If range is unknown, start with the highest range, 1000A.
3. Press trigger on left side of meter to open jaws. Now, clamp around a single conductor so it's centered and perpendicular in the jaws as shown in following illustration. Release trigger to clamp jaws and make sure they are fully closed.

NOTE : Position jaws around only one conductor centered and perpendicular to jaws. If jaws are placed around two or more current carrying conductors reading will be false. For example, if clamped around the line cord of an AC appliance, currents flowing through the cord tend to cancel each other giving a false reading.

4. Read current level at display. If needed for better resolution, select a lower range.

3.6 DC CURRENT MEASUREMENTS

1. Set function selector to **A =** for DC current measurements and select range. If range is unknown, start with the highest range, 1000A.
2. There may be a residual reading on the meter. Press the **Δ ZERO** button to zero the meter.
3. Clamp jaws around the conductor and read current level from display.

4. For maximum accuracy, remove the jaws from around the conductor and press the **Δ ZERO** button again the meter, Then repeat the measurement and use the second reading.

3.7 FREQUENCY MEASUREMENTS

1. Set function selector to Hz position. AUTO mode is on, range is automatically selected.
2. Plug black test lead into COM plug. Plug red test lead into HzΩF plug.
3. Connect test leads across desired measuring points. Make sure that peak of frequency signal does not exceed 500 V DC or AC.
4. Switch meter to **OFF** to conserve power.

3.8 CAPACITANCE MEASUREMENTS



CAUTION

1. **Discharge capacitors before connecting to the meter. Capacitors should not be measured "in circuit". Parallel components will invalidate the measurement.**
2. Verify that power is off and that any capacitors are discharged in circuit about to be tested. A capacitor can be safely discharged by connecting a 100 k Ω resistor across its leads.
3. Set function selector to capacitor position.
4. Plug black test lead into COM plug. Plug red lead into Hz Ω F plug.
5. Touch test leads to leads of capacitor. Be sure to observe polarity when testing polarized capacitors. Read capacity in μ F at display.
6. Accuracy Note: Measurement accuracy can be improved by first selecting the ZERO feature. Next, zero the display which automatically subtracts any residual capacitance in the meter and test leads. After zeroing, take your measurement. The new reading will be the true capacitance, residual capacitance subtracted from total capacitance.
7. Switch meter to **OFF** to conserve power.

3.9 AUTO POWER OFF

Auto Power Off is a feature that conserves battery power when you forget to turn the power off. When the Function switch position has not been changed for about 30 minutes, the meter automatically turns off. If you are using the meter to make several measurements without changing the position of the Function switch, the meter may turn off. To restart, simply rotate the Function switch at least one position.

3.10 MANUAL RANGING

The meter normally operates in the autoranging mode, but may be switched to manual ranging by the  **RANGE** button. The first press of the  **RANGE** button switches the meter from autoranging to the manual ranging mode and the  annunciator is displayed. The range does not change. With each additional press of the **RANGE** button, the meter steps to the next higher range until the highest range is reached, then it steps to lowest range. When a range is exceeded, a series of "beeps" are emitted until the correct range is reached. When any of the following modes are selected, the meter is automatically reverts to manual ranging. It may be necessary to preselect the correct range before making these measurements: MAX/MIN, HOLD, PEAK HOLD and Relative Mode.

To exit manual ranging mode and return to autoranging, hold the **RANGE** button down for about 2 seconds. The range symbol will disappear from the display and the **AUTO** annunciator will reappear.

3.11 DATA HOLD

The Data Hold feature permits the displayed reading to be frozen. For example, when damped around a conductor where light conditions are poor, press the **H HOLD** button. The reading is frozen and can be read after unclamping the meter and bringing it into the light. While the Data Hold mode is enabled, the **HOLD** annunciator is displayed. Press the **H HOLD** button a second time to exit this mode. The **HOLD** annunciator disappears from the display.

3.12 MAX/MIN HOLD

The MAX/MIN HOLD feature permits recording the lowest and highest value of a changing measurement. The first press of the **MAX/MIN** button enables the **MAX/MIN** Record mode. The highest and lowest values measured since

entering this mode are recorded and stored in memory. **MAX** or **MIN** or present values can be reviewed by successive presses of the **MAX/MIN** button. When MIN and HOLD are displayed, the reading shown is the "lowest" since entering this mode. When MAX and HOLD are displayed, the reading shown is the "highest" since entering this mode. When neither MAX nor MIN nor HOLD are displayed, but the manual ranging symbol remains, the present value is displayed and recording continues. Auto Power Off is overridden in the **MAX/MIN** Record mode so that recording may be extended for many hours if desired. To use the **MAX/MIN** Record mode properly, first connect the test leads to the point of measurement and then wait for the reading to stabilize. After it stabilizes, press the **MAX/MIN** button. If the button is pressed before the test leads are connected, the MIN reading will be zero. Also, the meter reverts to manual range operation upon entering the **MAX/MIN** Record mode. If the test leads are not yet connected, the meter will remain in the lowest range and may over-range when connected. If the variation swing of the value is great, it may be necessary to manually step to a higher range to prevent an over-range condition on the MAX value.

To exit the **MAX/MIN** Record mode, hold the **MAX/MIN** button down for about 2 seconds.

The **MAX/MIN** Record mode operates at the speed of the display update, about 2 times per second. That is, it records the MAX or MIN reading of the display. The speed of acquisition in this mode differs (slower) from the PEAK HOLD operation.

3.13 PEAK HOLD

The PEAK HOLD feature allows measurement of a peak value, for example, the starting current of a motor.

To measure peak current, clamp the meter jaws around the conductor and place the meter in a PEAK HOLD mode before starting the current. Select AC current, meter reverts to manual ranging, then press the **P PEAK** button twice so the **HOLD P** annunciator is displayed along with manual range indicator.

When measuring AC or DC voltage, frequency and resistance peak values with the meter, test leads are used. The general operation is similar to the description given for measuring current. When measuring AC or DC voltage and frequency, just as when measuring current, the meter is connected to the source being measured before power is applied. The remaining operation follows the description outlined for AC current. Peak resistance measurements must be made with the power off.

PEAK HOLD operates very fast, in a few milliseconds, long before it's shown at the display. Exit the PEAK HOLD mode by holding the **P PEAK** button down for about 2 seconds.

3.14 RELATIVE MODE

Relative mode (**Δ ZERO**) permits measurements with respect to a reference other than zero. First, measure a value for use as your reference, then press the **Δ ZERO** button. **ZERO Δ** is now displayed and the meter REFERENCE READING reverts to manual ranging. The reference value now becomes zero. All subsequent measurements are "relative" to the reference value. For example, for a reference of 316 ohms, first measure a 316 ohm value. Upon entering the **Δ ZERO** mode, a value of 316 ohms becomes zero, 320 ohms is read as 4 and 310 ohms is read as -6. If the variation from the reference is too great, an overrange may occur signaled by beeps. When this happens, up-range the meter then reestablish **Δ ZERO** reference on the new range.

To exit the relative mode, hold the **Δ ZERO** button down for about 2 seconds.

MAINTENANCE



WARNING

Remove test leads before changing batteries. Never operate instrument with battery compartment open.



CAUTION

Remove discharged batteries immediately to prevent damage from battery leakage.

BATTERY REPLACEMENT

The low battery symbol on the display indicates that battery power under load has dropped to about 7.4 V. The meter may still be used for a short time afterwards; however, replace the battery as soon as possible.

The battery compartment cover is located at the rear of the case - near bottom. To replace battery, remove screw in cover then remove cover. The meter uses a standard 9 V (NEDA 1604A / 6F22) battery. After replacing battery, be sure to replace cover and tighten screw to secure the compartment.

HELPFUL HINT, TEST LEADS

Only use the safety type test leads like those supplied with this meter for safe operation and to avoid false readings. Periodically inspect these test leads to ensure that the conductors are not intermittent, corroded or broken. Keep the plug area of the meter free of dirt.

Inspect the test leads for breaks in the insulation and replace as necessary.

DECLARATION OF CE CONFORMITY
according to EEC directives and NF EN 45014 norm



SEFRAM INSTRUMENTS & SYSTEMES
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Declares, that the below mentioned product complies with :

The European low voltage directive 73/23/EEC :
NF EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use.

The European EMC directive 89/336/EEC, amended by 93/68/EEC :
Emission standard EN 50081-1.
Immunity standard EN 50082-1.

Installation category: 600 V Cat II – 300 V Cat III

Pollution degree: 2

Product name : Clamp Meter
Model : MW3105

Compliance was demonstrated in listed laboratory and record in test report number: RC 3105

SAINT-ETIENNE :
December 1st, 1997

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